# THE NATIVE VEGETATION AND CROPS OF THE COLORADO DELTA IN THE SALTON BASIN.

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By Joseph Burtt Davy.

The following general observations were made on a hasty trip into the Colorado Desert between March 25 and April 2 of this year:

The region covers such a vast area that it was impossible to do anything in the way of a detailed study of its vegetation in a few days, as almost the whole time was occupied in travelling from point to point.

The flora is a limited one, very monotonous in character, tracts many miles in extent being covered by an almost uniform vegetation, of but few species and varying slightly in individual composition over large areas, according to the physical or chemical nature of the soil. On this account the native vegetation affords an excellent guide to the general condition of the land.

## PHYSICAL CONDITION OF THE SOIL.

Although there is a very marked difference between the vegetation of the sandy mesa and old beach lands and that of the alluvial plain, the *texture* of the soil on the plain itself has practically no effect on the vegetation. The same plants are found alike on the heavy "Imperial Clay" and on the Dune Sand, as well as on all the intermediate soils, with but few and unimportant exceptions. This fact is, however, of minor practical importance in determining the nature of the soil, because the texture of the surface soil is so clearly evident from its appearance to the sight and touch.

The relative humidity of the soil is much more clearly indicated, however. When the water-table is within about twenty feet of the surface, Arrowweed (*Pluchea sericea*) grows luxuriantly, forming dense groves six to ten feet high.

Wherever salt-springs occur, a dense growth of Salt-grass (*Distichlis spicata*) is found, and it is usually accompanied by luxuriant growths of Mesquit (*Prosopis juliflora*), Arrowweed (*Pluchea sericea*), and the Washington palm (*Washingtonia filifera*), although the latter is found nowhere on the plain, (except under cultivation) but only above the old beach line. The Mesquit is evidently dependent, in this region, upon the proximity of the ground-water, or upon periodical flooding. Although it is an exceedingly hardy tree, capable of withstanding adverse conditions inimical to the growth of the few other trees found in the region, it frequently happens that on areas

once covered with a growth of large Mesquit, only dead trees now remain, apparently indicating the lowering of the water-table. The river beds of both the Salton and New rivers are covered with a dense growth of vigorous Mesquit, and the latter also contains large Cottonwoods (*Populus*) and Willows (*Salix*), which gradually disappear at the lower end, or are represented by dead trees, indicating that the ground-water is no longer within reach.

Wild Heliotrope (*Heliotropium curassavicum*, L.), locally and most inappropriately called "Chinese Pusley," makes a rank and luxuriant growth on the banks of canals and ditches where there is a perceptible efflorescence of salts. It does not occur except where the soil is moist.

Salt-grass, Arrowweed, and Mesquit may therefore be taken as good indications of the proximity of the ground-water; Salt-grass indicating surface moisture, Arrowweed indicating water anywhere from the surface to twenty feet, and Mesquit indicating water from twenty feet down to an, at present, unknown depth. It would be of considerable interest, and perhaps of some practical value, to find out exactly how far the Mesquit can penetrate in search of ground-water. This could probably be determined with very close accuracy, as it appears that the lowering of the water-table below an, at present, uncertain point, results in the death of the trees over large areas.

### CHEMICAL CONDITION OF THE SOIL.

The chemical condition of the soil has a much more marked influence than the physical on the vegetation. This is clearly demonstrated by the distribution of the various "alkali weeds" which occur in equal abundance and luxuriance on all soils in which alkali occurs, from the light "blow-away" dune sands up to the heaviest clays.

### THE CREOSOTE LANDS.

The best soils of the region from the culture stand point, *i. e.*, those freest from alkali and of a loamy texture—are characterized by a luxuriant growth of the bush locally called "Greasewood," but better known as Creosote bush (*Larrea tridentata*). The use of the name "Greasewood" should be dropped in connection with this plant, as it is more generally and more correctly used to designate one of the most alkali-indicative plants of Utah, Nevada and Northeastern California (*Sarcobatus vermiculatus*), which is not found in the Salton Basin. The name "Creosote-bush" is thoroughly distinctive, and will not lead to the supposition that this shrub indicates the presence of alkali, which is not the case. As a rule, the Creosote-bush prefers a light, sandy or gravelly soil, well-drained and almost free from alkali; it is not an alkali plant, and usually grows well

above the alkali line, but at its lower limit a few scattered specimens are often found, in the salt-sage belts, in a mixture of gravel and clay, with some alkali. Mr. Snow found "a few scattering live bushes" growing on soil containing .45 % of salts, or 108,000 lbs. per acre, in 6 ft.; it rarely occurs in such places, however, and then only sparingly and in stunted form. Its presence under such adverse conditions may perhaps be traceable to the seepage or rise of alkali into that spot after the bushes had become established. This theory finds partial confirmation in the occasional occurrence of small alkali spots in the heart of a large area of excellent loamy land, such spots being indicated by the presence of "alkali weeds," particularly Saltwort (*Suœda*), Hop-sage (*Atriplex canescens*) and Scrub Salt-sage (*Atriplex sp.*), associated with the Creosote-bush.

Wherever Creosote-bush occurs abundantly and luxuriantly it is probable that alfalfa and many other crops can be raised satisfactorily. Wherever it occurs mixed with alkali weeds greater care must be exercised in the manipulation of the soil, either on account of lesser permeability of the irrigation water or the presence of larger amounts of alkali.

The entire absence of, or poor growth of, Creosote-bush on lands producing other vegetation, generally speaking (and with a few exceptions doubtless), indicates that the soil is compact, clayey, and hard to work, and usually contains from .6 to over 1% of salts. Such soils will probably require to be leached and possibly to be tile-drained in order to make them respond to cultivation.

It has been suggested that the tracts absolutely free from all vegetation, which are found in some sections on the heavy clay lands, owe their lack of vegetation to the standing of water on the surface for a long period; that they are, in fact, dry lakes, "sinks," or evaporation basins, such as are commonly met with in all desert areas. Without having been able to study the contours of these barren areas, it is impossible to state definitely that this is the case, but the explanation seems a probable one. If this view is correct, then it will follow that the entire absence of all vegetation from an area does not necessarily mean either that the soil is too heavy or that it is too strongly charged with salts for vegetation to flourish, but that the long continued standing of the water has prevented the germination of seeds. Mere seasonal flooding has an entirely opposite effect, moistening the soil for some depth, but drying off the surface in time to allow seeds to germinate.

### THE SALT-SAGE LANDS.

The presence of the Salt-sages (shrubby species of *Atriplex*), better known, but erroneously, as "Sage-brush," is invariably indica-

tive of the presence of alkali in varying amounts. The Salt-sages include the Hop-sage or Shad-scale and several other species. Where they grow in company with Creosote-bush there is less alkali than where they grow by themselves, but in almost all cases where they grow alone there appears to be from .4 to over 1.% of alkali salts. In such soils great care will have to be exercised not to allow an accumulation of salts at the surface.

### THE SALTWORT LANDS.

The worst lands in the whole region, as regards presence of alkali, are indicated by the growth of three kinds of "alkali weeds," each kind apparently indicating different degree or kind of salt impregnation.

Salt-wort (*Suæda*) is by far the most abundant of these three, and is the principal alkali indicator of the whole region. The amount of alkali required by this plant is considerable, ranging somewhere between .4 and over 1. %, but its exact limits have not yet been determined. It appears to require much more salt than the salt-sages do, and though they often grow in company with each other, it may be considered that where salt-wort or "alkali weed" grows alone, in abundance and luxuriance, there is more alkali than where the salt-sages or "Sage-brush" grows alone.

Rabbit-brush (*Bigelovia veneta*) is not generally distributed—in fact it is a rare plant in the region, and appears to grow only where the salts are excessively strong.

Kern Greasewood (*Allenrolfea occidentalis*) is equally scarce in the vicinity of Imperial. It usually appears to be indicative of excessively strong salts and also of the presence of *black alkali*.

The soils on which the three last-named plants occur contain so much alkali that only alkali-resistant crops should be attempted there. Mr. Rockwood reports that excellent alfalfa is raised on Saltwort lands at Yuma, but it must be borne in mind that the soils at Yuma are generally much more easily leached of their salts than are most of the *Saltwort* lands in the Imperial country. As there is so much land that is practically free from alkali, and that is well adapted to the cultivation of alfalfa, it would be the wisest policy to turn attention to it first, leaving the Saltwort lands to be handled later.

## CROPS FOR THE COLORADO DELTA IN THE SALTON BASIN.

In experimenting in a new country and with new conditions, it is wise to try first mainly those things which are most likely to be successful, at the same time neglecting no opportunity to try other things on a smaller scale. On account of the nature of the soil and climate and the situation of the valley, it is probable that the Colorado Delta will have its greatest development in the line of stock-

raising and dairying. Nevertheless, the growing of certain fruits for the early markets of Chicago and the East should not be overlooked, particularly in the line of the production of cantaloupes, watermelons, certain classes of grapes (particularly the Thompson seedless), figs, and dates.

Alfalfa, barley, the sorghums, stock, dairy products, honey, sugar-beets, the fruits above mentioned, and possibly cotton and some of the cereals are likely to be the staple products of the delta. Sugar cane, oats, rice, corn, hemp, flax, and most of the fruits are not likely to succeed. The Sisal hemp plant should be tried; it is more likely to succeed on the mesa lands than on the alluvial plain.

### METHOD OF TREATMENT.

Fall-sowing should be practised wherever possible, except in the case of crops susceptible to low temperatures, such as corn and teosinte. Experience has already shown that barley and wheat thrive admirably when sown by the middle of September. Late sowing will, in the case of such crops, be likely to result in stunted growth, and possibly in entire lack of development. By early sowing it will also be possible to secure an early market in many cases.

### BARLEY.

When sown by the middle of September, barley near Calexico has made a growth of three and one-half to four feet and headed out by the last of March; it stools out remarkably, producing from seventy to ninety stems from a single root-stock. Attention might be given to some of the fine Bavarian brewing barleys recently introduced by the U. S. Department of Agriculture, for which there may be a good demand in the principal brewing centers, just as there is for Oregon barley, if they can be grown satisfactorily in this region.

### ALFALFA.

In preparing the ground for alfalfa it is very important *not* to flood the land after sowing, until the plants have covered the ground well, otherwise a hard crust is formed through which it is almost impossible for the seedlings to break. The land should be well irrigated *before* sowing, preferably twice; then plowed as soon as the surface is sufficiently dry, and harrowed to a fine tilth, in which the seed should be sown and left to take care of itself till well up. There will be enough moisture retained in the soil to provide a good stand in this way, without danger of caking the surface or scalding the seedlings, or causing a condensation of salts. Alfalfa will do best in the lighter, loamy soils. It is hard to start alfalfa in soils of .2 to .4 % of salts; it does best in soils with not more than from 0 to .2 %.

BEETS.

Beets should do well as a winter crop on the lighter, sandy soils. It is not likely that sugar beets can be *profitably* grown on the heavier soils, as the sugar content and purity coefficients are likely to be low.

The Mangold Wurzel (*var. rapa*) is a valuable cattle food, but is not likely to stand the summer heat; it should be tried as a winter crop for summer feeding, as an addition to the alfalfa ration.

AUSTRALIAN SALT-BUSH.

Australian Salt-bush (*Atriplex semibaccata*) can be grown as a forage plant on all lands which are too saline to raise alfalfa and other crops. Some care must be exercised in sowing the seed, in order to produce a good stand, and a bulletin and circular giving a full account of the plant, with instructions as to sowing, can be had on application to the Director, Agricultural Experiment Station, Berkeley, Cal.

THE SORGHUMS.

It is probable that all of the Sorghum races, both saccharine and non-saccharine, will thrive, and will prove important forage crops, as they are in Northeastern Texas. The Sorghums include not only Sorghum, but also Kaffir corn, Jerusalem corn, Egyptian corn, Durra, Millo maize, Broom corn and Guinea corn.

Four crops of Jerusalem corn have been obtained at Indio from a single sowing. This variety is said to be rather more prolific than Egyptian corn, though both thrive well, there and at Calexico.

On account of the scarcity of Sorghum seed in the market and its high price, it might be profitable to raise it for seed as well as for forage.

CORN.

Corn is sensitive to alkali and is not likely to thrive in soils containing more than .2% of salts. It is probable that Teosinte is equally sensitive. Both should be tried as summer crops, as they will not tolerate low winter temperatures.

FIGS.

The Smyrna fig industry has now been placed on what seems to be a thoroughly firm basis, and the quality of the California product is superior to that of the imported article. In view of the fact that in 1900 we imported 8,812,481 pounds of dried figs, valued at $513,895, there would seem to be a market for all the Smyrnas we can produce. The area over which the Smyrna fig can be satisfactorily cultivated is so limited that the likelihood of severe competition is reduced. The successful caprification of the flowers and handling of the crop are not difficult, although they require care and skill, but not more than is

required in the case of many of our special crops, while the prospects for good returns and good markets are much greater than in the case of cotton and sugar cane. Figs thrive at Indio, and should be thoroughly tested at Calexico and Imperial, particularly the Smyrna varieties, together with the necessary capri-figs. Some attention should also be given to the raising of the finest varieties of table figs, with a view to catching an early market. These should be carefully experimented with, however, before attempting to launch out extensively; it is better to make haste slowly in such matters.

A fully illustrated account of the Smyrna fig industry and the process of caprification is contained in the Yearbook of the United States Department of Agriculture for 1900.

### DATES.

The Colorado Desert is one of the few places in the United States where the Date palm is likely to grow to perfection. At Indio Mr. G. W. Durbrow now has a number of young date palms, four years old from the seed, which are six feet high. The Date should be raised from suckers of high-grade trees in preference to raising it from seed, as seedlings are apt to deteriorate; care must be taken to secure both male and female trees. A fully illustrated account of the Date industry is contained in the Yearbook of the United States Department of Agriculture for 1900. In this article we find the following note: "The value of the dates imported into the United States, alone, averaged for the ten years ending June 30, 1900, $402,762 per annum, as appraised at the exporting point. The real value when received at the American port was doubtless 50 per cent greater, or $600,000 a year, an amount now exceeded only by the imports of two other dried fruits—Zante currants and Smyrna figs."

### TREES FOR TIMBER, SHADE, AND FUEL.

A species of Cottonwood (*Populus*) from the Colorado bottoms and another species from the vicinity of Colton have been used at Indio with success on account of the rapidity of their growth and the good shade they afford. They are objected to on two counts, however: first, the quantity of "cotton" which they shed, and, second, the poor quality of the wood for fuel and other purposes. The first difficulty can be obviated by propagating only from poles or cuttings of *male* trees, which do not produce cotton; the second, only by planting some other kind of tree.

*Eucalypts.* Some settlers have already invested in seedling Blue Gums (*Eucalyptus globulus*). This species is entirely *unsuited* to the climatic conditions of the region. It will not stand either the low winter temperature or the dry heat of summer.

The true Red Gum (*Eucalyptus rostrata*), the Manna Gum (*Eucalyptus viminalis*), and the Yate (*Eucalyptus cornuta*) are likely to succeed, and are hardwood trees of rapid growth. The Red Gum produces a strong, hard, heavy and extremely durable wood, suitable for fence posts, piles, and railroad ties, and said to make a better fuel than that of the Blue Gum. The wood of the Manna Gum is not as strong as that of many other species, but is frequently employed for shingles, fence rails, and ordinary building purposes. The Yate yields a hard, tough, and elastic wood, suitable for shafts and frames of carts, and considered equal to ash.

The Mesquit is so thoroughly adapted to the climatic and soil conditions of the region that it might be grown in small shelter blocks around the house, as a windbreak and to furnish fuel, and shelter and feed for hogs and cattle. It grows very readily from seed, often coming up as a volunteer on irrigated land and the banks of ditches, and making a growth of from three to four feet in a year with a good supply of water; under favorable conditions it makes a tree fifty feet in height, with a trunk three feet in diameter at the base.

Both the native Washington palm and the true Date palm can be grown for ornament in almost any soil in the region.

In conclusion, the writer would call attention to the fact that in view of the vast area of land, about 1¼ million acres, of which some 160,000 acres has already been taken up, being brought under irrigation, the large number of families already settled upon this land, the peculiarities of the soil and climate of the region, differing entirely from any other region of the State, and largely different from anything else in the United States, that it would be of immense value to the settlers in the region, as well as of great scientific value, to have a State Experiment Station established, preferably in the vicinity of Calexico, and under the direction of this Station, where practical experiments could be carried on, illustrating the best methods of treating the soil and demonstrating what crops can be grown and how they should be handled.

A local station, situated on average land, placed on a permanent basis and with adequate income, would be an object lesson to the farmer of what can be accomplished by the best methods of farming. It would cost at least $3000 to establish and equip such a station, and about $2500 per annum to maintain it.

Berkeley, April, 1902.